17. $f(x) = \ln(3-x)$ about $x=2$

$\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3}$

$\ln(1-x) = -x - \frac{x^2}{2} - \frac{x^3}{3}$ centered on 0

$\ln(1-(x-2))$, $\ln(1-x+2)$ } $= -(x-2) - \frac{(x-2)^2}{2} - \frac{(x-2)^3}{3}$ centered on 2

$\ln(3-x)$

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$f = \ln(3-x)$ $f(2) = 0$

$f' = \frac{-1}{3-x}$ $f'(2) = -1$

$f'' = -\frac{1}{(3-x)^2}$ $f''(2) = -1$ $-(3-x)^{-2}$ $-(-2)(3-x)^{-3}(-1)$

$f''' = \frac{-2}{(3-x)^3}$ $f'''(2) = -2$

$0 - 1(x-2) - 1\frac{(x-2)^2}{2} - 2\frac{(x-2)^3}{3!}$

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15 $\int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$

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20. $\sum_{n=1}^{\infty} \frac{(x-2)^n}{n\,3^n}$

$\lim_{n\to\infty} \left| \frac{(x-2)^{n+1}}{(n+1)\,3^{n+1}} \cdot \frac{n\,3^n}{(x-2)^n} \right| = \lim_{n\to\infty} \left| \frac{n}{n+1} \cdot \frac{x-2}{3} \right|$ ($\frac{n}{n+1} \to 1$)

$= \frac{|x-2|}{3} < 1$

$|x-2| < 3$

$-3 < x-2 < 3$

$-1 < x < 5$

$x=-1$: $\sum \frac{(-3)^n}{n\,3^n} = \sum \frac{(-1)^n}{n} = -1 + \frac{1}{2} - \frac{1}{3} + \frac{1}{4} \cdots$ converge by AST

$x=5$: $\sum \frac{3^n}{n\,3^n} = \sum \frac{1}{n}$ harmonic div

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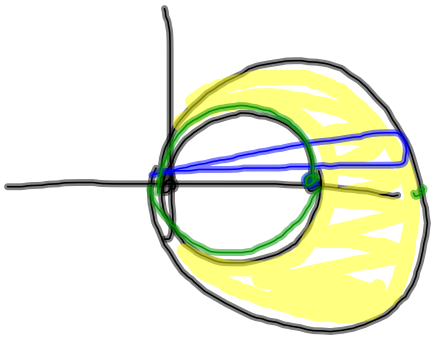
21. in $r = 2\cos\theta$ out $r = \cos\theta$



θ	r
0	1
$\frac{\pi}{2}$	0
π	-1

$$2\int_0^{\pi/2} \frac{1}{2}(2\cos\theta)^2 - \frac{1}{2}(\cos\theta)^2 \, d\theta$$

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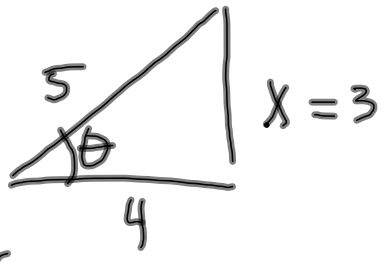
23. θ inc at $\frac{d\theta}{dt} = 3\ \frac{\text{rad}}{\text{min}}$



find $\frac{dx}{dt}$

$x = 3$

$\sin\theta = \frac{x}{5}$

$x = 5\sin\theta$

$$\frac{dx}{dt} = 5\cos\theta \frac{d\theta}{dt} = 5 \cdot \left(\frac{4}{5}\right) \cdot 3$$

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24. $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!}$

$f'(x) = \sin(x^2)$ coeff of x^7

$f' = \sin x^2 = x^2 - \frac{x^6}{3!} + \frac{x^{10}}{5!}$

$f = \frac{x^3}{3} - \frac{x^7}{7 \cdot 3!}$ $\qquad \frac{1}{7 \cdot 3!} = \frac{1}{42}$

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25 $\lim_{n \to \infty} \sum_{i=1}^{n} \sqrt{x_i}\, \Delta x = \int_a^b \sqrt{x}\, dx$

$= \frac{2}{3} x^{3/2} \Big|_a^b$

$= \frac{2}{3}\left(b^{3/2} - a^{3/2} \right)$

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Review 18 Properties & applications of definite integrals

$$\int_a^a f(x)\,dx = 0$$

$$\int_b^a f(x)\,dx = -\int_a^b f(x)\,dx$$

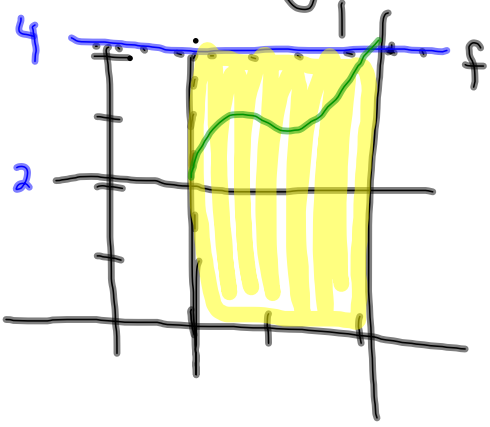
$$\int_a^b k f(x)\,dx = k\int_a^b f(x)\,dx$$

Mar 30-8:20 AM

p180 # 2 Quick poll

f is continuous on $[1,3]$ & $2 \le f(x) \le 4$

max value of $\int_1^3 f(x)\,dx$



$$4 \le \int_1^3 f(x)\,dx \le 8$$

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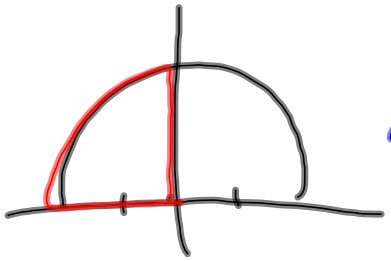
#3 Q2P



$g = \int_{0}^{-2} f(x)\,dx \quad -\int_{-2}^{0} f(x)\,dy$

$\pi \cdot 2^2 = 4\pi$ whole circle

$-\pi$ quarter circle

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Volumes of revolution

1. sketch the region that is revolved
2. rectangle — vertical (dx)
   horizontal (dy)
3. sketch the slice (rotate the rectangle)

then you will know which one:

disk $\int_a^b \pi r^2\,dx$ or dy

washer $\int_a^b \pi R^2 - \pi r^2\,dx$ or dy

shell $\int_a^b 2\pi r h\,dx$ or dy

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#3 top half of pie3

$y=\sqrt{x}$

$y=\frac{1}{2}x$

$\sqrt{x}=\frac{1}{2}x$

$x=\frac{x^2}{4}$ $x=4$

about x-axis

$\int_0^4 \pi(\sqrt{x})^2-\pi(\frac{1}{2}x)^2\,dx$

$R=\sqrt{x}$

$r=\frac{1}{2}x$

$\pi\int_0^4 x-\frac{x^2}{4}\,dx$

$\pi\left(\frac{x^2}{2}-\frac{x^3}{12}\Big|_0^4\right.$

$\pi\left(\frac{4^2}{2}-\frac{4^3}{12}-0\right)$

$\pi\left(8-\frac{64}{12}\right)=\pi\left(\frac{8}{3}-\frac{16}{3}\right)$

$=\pi\left(\frac{24-16}{3}\right)$

$=\frac{8\pi}{3}$

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Volumes of know cross section

1. sketch picture

base

cross section ⊥ y-axis

2. $\int_a^b$ area of cross-section dx or dy

dx ⊥ to x axis

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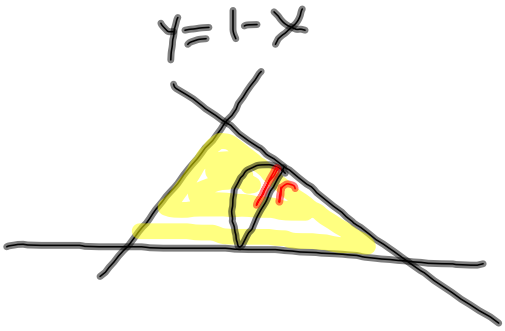
p183 # 1 The base of a solid . . .



$$\int \frac{1}{2}\pi r^2 \, dx$$

$$\int_0^1 \frac{1}{2}\pi \left(\frac{1}{2}(1-x)\right)^2 dx$$

$2r = y$

$r = \frac{1}{2}y = \frac{1}{2}(1-x)$

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